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Conference Abstract

Mitigation of Mercury Contamination in an Ore Collection

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Abstract

The National Rock and Ore Collection at the Smithsonian Institution's National Museum of Natural History includes mercury ore specimens stored at its Museum Support Center in Suitland, Maryland. Two decades after the ore collection was moved from historic metal clad wooden cabinets with felt gaskets to modern steel cabinets with neoprene foam gaskets, it became apparent that elemental mercury vapor generated from the specimens was accumulating within the storage units, creating visible mercury deposits on cabinet interior surfaces and drawers, as well as the paperboard storage trays and paper specimen labels inside the drawers. Concerns were raised about the potential health hazard to users of the collection, as well as potential cross-contamination of non-mercury-bearing specimens, housing materials and equipment. The Museum's collection manager, conservator, and industrial hygienist developed three phases of mitigation strategies, which were applied and analyzed for effectiveness between 2011 and 2016.

The first phase involved creating special vapor barrier packaging for each mercury ore using Marvelseal®, welded on three sides by the supplier, and frame sealing tape to secure the fourth side; disposal of all trays and replacement of trays for the non-mercury-bearing specimens; extensive cleaning of the cabinet interiors using Mercury Absorb Sponges; and lining each drawer and cabinet with MicroChamber scavenger sheets. Utilizing a Jerome Mercury Vapor Analyzer, measurements indicated a 40-50% reduction in mercury concentrations within the affected cases.

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There were still visible residual mercury deposits, so a second, more rigorous phase of cleaning was conducted on all accessible interior cabinet and drawer surfaces, paying special attention to unpainted metal hardware. A modified solution of Lugol's iodine was used, followed by isopropyl alcohol wipes to remove the residual iodine solution. This second phase led to a further reduction in mercury vapor of 60-80% from the original measurements.

The cases were securely closed for one year, and subsequent measurements indicated a significant re-accumulation of mercury vapor. During the third phase of mitigation, zeolite scavenger sheets were inserted between drawers and over bagged specimens, and MicroChamber sheets from the second phase were replaced. This resulted in mercury vapor concentration reductions back to 60-80% of the original measurements. However, the median concentration still exceeded the conservative occupational health exposure limit of 0.025 mg/M3. Subsequent investigation suggests that residual mercury residue on inaccessible interior cabinet surfaces is the limiting factor preventing complete and permanent mitigation.

Keywords

Mercury, Mitigation, Ore

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